

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|--|---|--|
| Applicant's or agent's file reference IP/P7154 / WOD | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. | |
| International application No. PCT/GB 03/02865 | International filing date (day/month/year) 03/07/2003 | (Earliest) Priority Date (day/month/year) 11/07/2002 |
| Applicant QINETIQ LIMITED | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

2



None of the figures.

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International application No.

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Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

A photodetector circuit incorporates an avalanche photodiode structure having a contact layer (14) forming an ohmic contact over an annular region (18) with the annular guard ring (8). In the fabrication process, the starting substrate can either be the handle wafer of a p- silicon-on-insulator wafer, or a p-Si substrate with an insulating SiO₂ layer (4). A window (6) is produced in the insulating layer (4) by conventional photolithographic and etching. A n+ guard ring (8) is created by diffusing donor impurities into the substrate, and a thinner insulating SiO₂ layer (22) is thermally grown so as to cover the exposed surface of the substrate within the window (6). P-type dopant is then implanted through the thin oxide layer to increase the doping level near the surface of the substrate. Subsequently a second window (24) is made in the insulating layer (22), and the layer (12) is then epitaxially grown selectively on the area of the substrate exposed by the window (24) in the insulating layer (22). After the epitaxial layer (12) has been grown the remaining part of the insulating layer (22) is removed by wet oxide etch which exposes an annular portion (26) of the underlying guard ring (8). Subsequently a n+ silicon epitaxial layer (14) is deposited on the surface of the device, and forms an ohmic contact with the guard ring (8), and simultaneously forms the top contact of the photodiode.

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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L31/18 H01L31/107 H01L27/146

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|--------------------------------------|
| X | US 2002/024058 A1 (BIRCH STEVEN W ET AL) 28 February 2002 (2002-02-28) paragraphs '0110! - '0118!; claims 1-6,13,22; figure 20 | 1-4,8-24 |
| A | EP 1 220 325 A (FUJITSU QUANTUM DEVICES LTD) 3 July 2002 (2002-07-03) paragraph '0025! - paragraph '0042! paragraph '0078! - paragraph '0086!; figures 3-5,10,13,15,18 ----- -/-- | 1-3,10, 12-14, 18-20, 23,24 |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *G* document member of the same patent family

Date of the actual completion of the international search

27 July 2004

Date of mailing of the international search report

05/08/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Voignier, V

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|--|
| A | <p>US 5 596 186 A (KOBAYASHI KOJI) 21 January 1997 (1997-01-21)</p> <p>column 6, line 66 - column 7, line 31; claims 4,6; figure 1</p> <p>-----</p> | <p>1,2,10, 12-14, 18-20, 22-24</p> |
| A | <p>PATENT ABSTRACTS OF JAPAN. vol. 0080, no. 78 (E-237), 10 April 1984 (1984-04-10) & JP 58 223382 A (TOKYO SHIBAURA DENKI KK), 24 December 1983 (1983-12-24) abstract</p> <p>-----</p> | <p>1,5,12</p> |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 03/02865

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|----|---------------------|---|--|
| US 2002024058 | A1 | 28-02-2002 | GB 2367945 A TW 543197 B | 17-04-2002 21-07-2003 |
| EP 1220325 | A | 03-07-2002 | JP 2002252366 A CA 2365454 A1 EP 1220325 A2 US 2002113282 A1 | 06-09-2002 19-06-2002 03-07-2002 22-08-2002 |
| US 5596186 | A | 21-01-1997 | JP 7221341 A JP 3243952 B2 JP 7226532 A US 5623108 A | 18-08-1995 07-01-2002 22-08-1995 22-04-1997 |
| JP 58223382 | A | 24-12-1983 | NONE | |